



4N70K-MT

Power MOSFET

4.4A, 700V N-CHANNEL POWER MOSFET

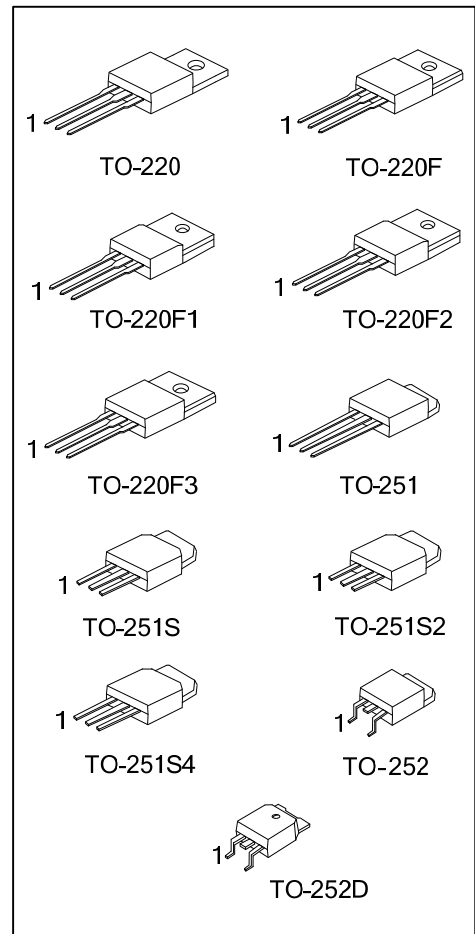
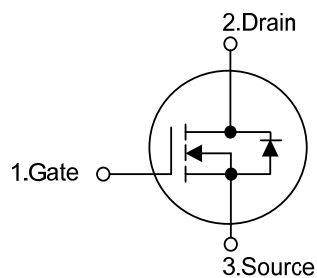
■ DESCRIPTION

The UTC 4N70K-MT is a high voltage power MOSFET and is designed to have better characteristics, such as fast switching time, low gate charge, low on-state resistance and high rugged avalanche. This high speed switching power MOSFET is usually used in power supplies, PWM motor controls, high efficient DC to DC converters and bridge circuits.

■ FEATURES

- * $R_{DS(ON)} < 3.2\Omega$ @ $V_{GS} = 10\text{ V}$, $I_D = 2.2\text{ A}$
- * Fast Switching Capability
- * Avalanche Energy Specified
- * Improved dv/dt Capability, High Ruggedness

■ SYMBOL



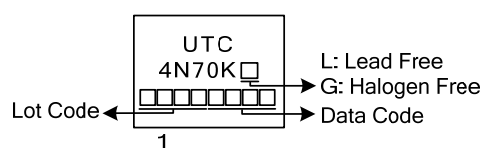
ORDERING INFORMATION

Ordering Number		Package	Pin Assignment			Packing
Lead Free	Halogen Free		1	2	3	
4N70KL-TA3-T	4N70KG-TA3-T	TO-220	G	D	S	Tube
4N70KL-TF3-T	4N70KG-TF3-T	TO-220F	G	D	S	Tube
4N70KL-TF1-T	4N70KG-TF1-T	TO-220F1	G	D	S	Tube
4N70KL-TF2-T	4N70KG-TF2-T	TO-220F2	G	D	S	Tube
4N70KL-TF3-T	4N70KG-TF3-T	TO-220F3	G	D	S	Tube
4N70KL-TM3-T	4N70KG-TM3-T	TO-251	G	D	S	Tube
4N70KL-TMS-T	4N70KG-TMS-T	TO-251S	G	D	S	Tube
4N70KL-TMS2-T	4N70KG-TMS2-T	TO-251S2	G	D	S	Tube
4N70KL-TMS4-T	4N70KG-TMS4-T	TO-251S4	G	D	S	Tube
4N70KL-TN3-R	4N70KG-TN3-R	TO-252	G	D	S	Tape Reel
4N70KL-TND-R	4N70KG-TND-R	TO-252D	G	D	S	Tape Reel

Note: Pin Assignment: G: Gate D: Drain S: Source

4N70KL-TA3-T (1) Packing Type (2) Package Type (3) Green Package	(1) T: Tube, R: Tape Reel (2) TA3: TO-220, TF3: TO-220F, TF1: TO-220F1, TF2: TO-220F2, TF3: TO-220F3, TM3: TO-251, TMS: TO-251S, TMS2: TO-251S2, TMS4: TO-251S4, TN3: TO-252, TND: TO-252D (3) L: Lead Free, G: Halogen Free and Lead Free
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MARKING



■ **ABSOLUTE MAXIMUM RATINGS** ($T_A = 25^\circ\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	RATINGS	UNIT
Drain-Source Voltage		V_{DS}	700	V
Gate-Source Voltage		V_{GS}	± 30	V
Drain Current	Continuous	I_D	4.4	A
	Pulsed (Note 2)	I_{DM}	17.6	A
Avalanche Energy	Single Pulsed (Note 3)	E_{AS}	180	mJ
Power Dissipation	TO-220	P_D	106	W
	TO-220F/TO-220F1		36	W
	TO-220F2/TO-220F3			
	TO-251/TO-251S		49	W
	TO-251S2/TO-251S4			
	TO-252/TO-252D			
Peak Diode Recovery dv/dt (Note 4)		dv/dt	4.5	V/ns
Junction Temperature		T_J	+150	$^\circ\text{C}$
Operating Temperature		T_{OPR}	-55 ~ +150	$^\circ\text{C}$
Storage Temperature		T_{STG}	-55 ~ +150	$^\circ\text{C}$

Notes: 1. Absolute maximum ratings are those values beyond which the device could be permanently damaged.

Absolute maximum ratings are stress ratings only and functional device operation is not implied.

2. Repetitive Rating : Pulse width limited by maximum junction temperature

3. $L = 22.5\text{mH}$, $I_{AS} = 4\text{ A}$, $V_{DD} = 50\text{V}$, $R_G = 25\ \Omega$, Starting $T_J = 25^\circ\text{C}$

4. $I_{SD} \leq 4.4\text{A}$, $di/dt \leq 200\text{A}/\mu\text{s}$, $V_{DD} \leq BV_{DSS}$, Starting $T_J = 25^\circ\text{C}$

■ **THERMAL DATA**

PARAMETER		SYMBOL	RATINGS	UNIT
Junction to Ambient	TO-220/TO-220F TO-220F1/TO-220F2 TO-220F3	θ_{JA}	62.5	$^\circ\text{C/W}$
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		110	$^\circ\text{C/W}$
Junction to Case	TO-220	θ_{JC}	1.18	$^\circ\text{C/W}$
	TO-220F/TO-220F1 TO-220F3		3.47	$^\circ\text{C/W}$
	TO-220F2		3.4	$^\circ\text{C/W}$
	TO-251/TO-251S TO-251S2/TO-251S4 TO-252/TO-252D		2.55	$^\circ\text{C/W}$

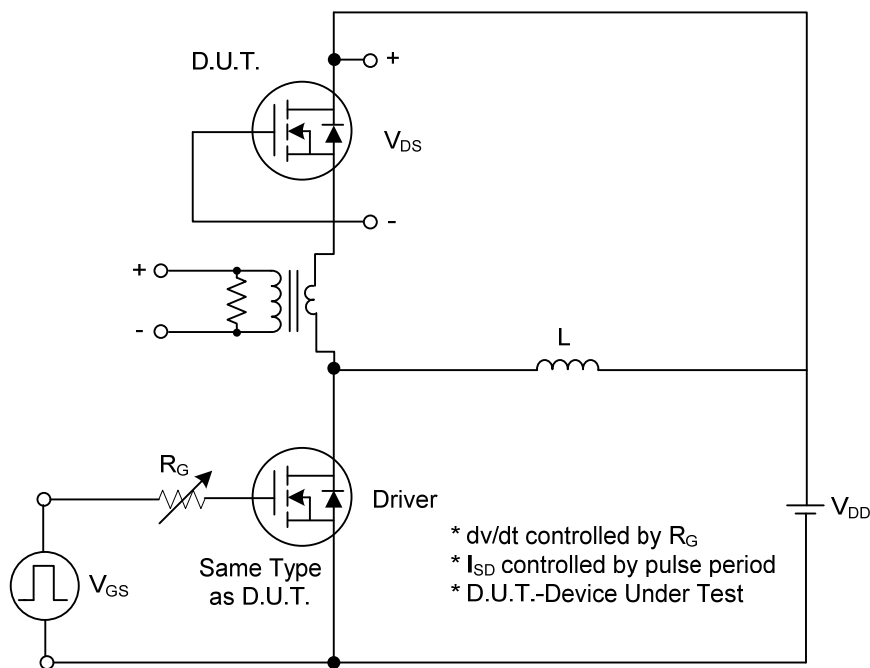
■ **ELECTRICAL CHARACTERISTICS** ($T_A = 25^\circ\text{C}$, unless otherwise specified)

PARAMETER		SYMBOL	TEST CONDITIONS	MIN	TYP	MAX	UNIT
OFF CHARACTERISTICS							
Drain-Source Breakdown Voltage		BV_{DSS}	$V_{GS} = 0\text{ V}, I_D = 250\text{ }\mu\text{A}$	700			V
Drain-Source Leakage Current		I_{DSS}	$V_{DS} = 700\text{ V}, V_{GS} = 0\text{ V}$			10	μA
Gate-Source Leakage Current	Forward	I_{GSS}	$V_{GS} = 30\text{ V}, V_{DS} = 0\text{ V}$			100	nA
	Reverse		$V_{GS} = -30\text{ V}, V_{DS} = 0\text{ V}$			-100	
Breakdown Voltage Temperature Coefficient		$\triangle BV_{DSS}/\triangle T_J$	$I_D = 250\mu\text{A}$, Referenced to 25°C		0.6		V/°C
ON CHARACTERISTICS							
Gate Threshold Voltage		$V_{GS(TH)}$	$V_{DS} = V_{GS}, I_D = 250\text{ }\mu\text{A}$	2.0		4.0	V
Static Drain-Source On-State Resistance		$R_{DS(ON)}$	$V_{GS} = 10\text{ V}, I_D = 2.2\text{ A}$			3.2	Ω
DYNAMIC CHARACTERISTICS							
Input Capacitance		C_{ISS}	$V_{DS} = 25\text{ V}, V_{GS} = 0\text{ V}, f = 1\text{ MHz}$		350	550	pF
Output Capacitance		C_{OSS}			55	85	pF
Reverse Transfer Capacitance		C_{RSS}			5	10	pF
SWITCHING CHARACTERISTICS							
Turn-On Delay Time		$t_{D(ON)}$	$V_{DD} = 30\text{V}, I_D = 0.5\text{A},$ $R_G = 25\Omega$ (Note 1, 2)		50	70	ns
Turn-On Rise Time		t_R			40	60	ns
Turn-Off Delay Time		$t_{D(OFF)}$			75	90	ns
Turn-Off Fall Time		t_F			30	45	ns
Total Gate Charge		Q_G	$V_{DS}= 50\text{V}, I_D= 1.3\text{A},$ $V_{GS}= 10\text{ V}$ (Note 1, 2)		14		nC
Gate-Source Charge		Q_{GS}			5		nC
Gate-Drain Charge		Q_{GD}			2.5		nC
SOURCE- DRAIN DIODE RATINGS AND CHARACTERISTICS							
Drain-Source Diode Forward Voltage		V_{SD}	$V_{GS} = 0\text{ V}, I_S = 4.4\text{ A}$			1.4	V
Maximum Continuous Drain-Source Diode Forward Current		I_S				4.4	A
Maximum Pulsed Drain-Source Diode Forward Current		I_{SM}				16	A

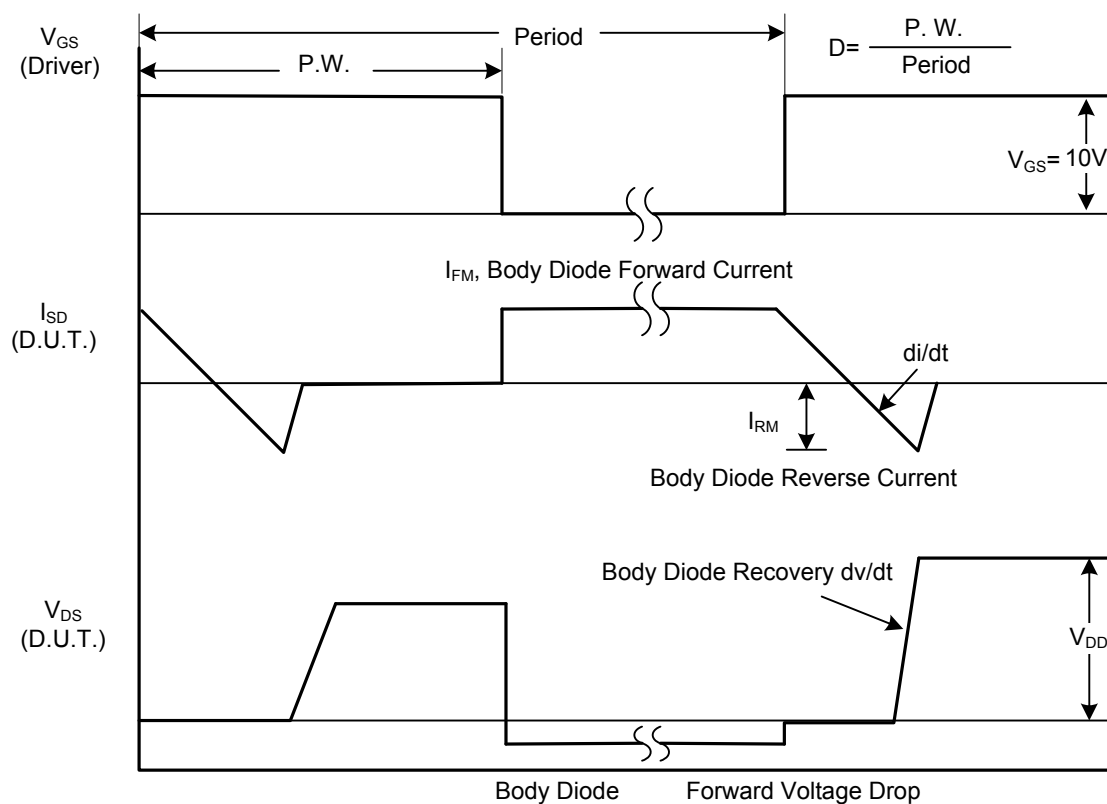
Notes: 1. Pulse Test: Pulse width $\leq 300\mu\text{s}$, Duty cycle $\leq 2\%$

2. Essentially independent of operating temperature

■ TEST CIRCUITS AND WAVEFORMS

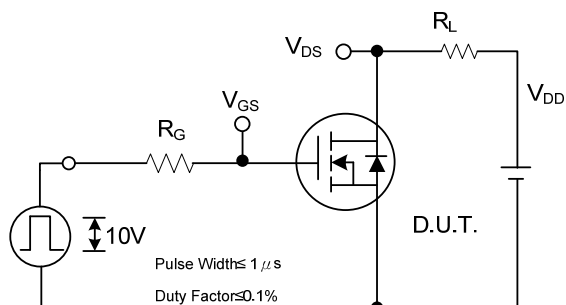


Peak Diode Recovery dv/dt Test Circuit

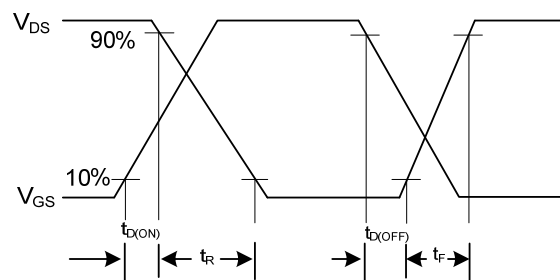


Peak Diode Recovery dv/dt Waveforms

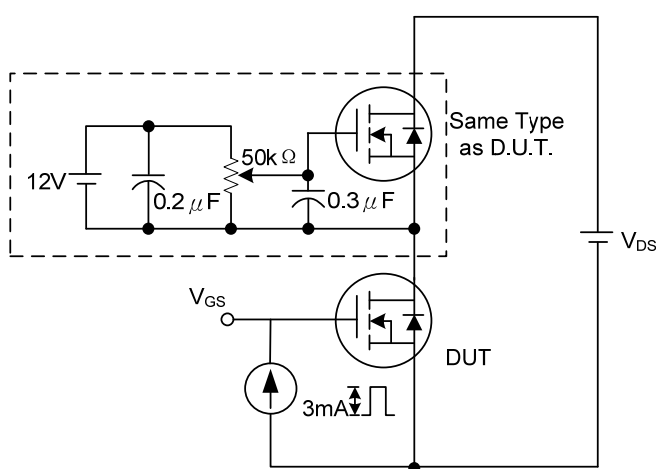
■ TEST CIRCUITS AND WAVEFORMS (Cont.)



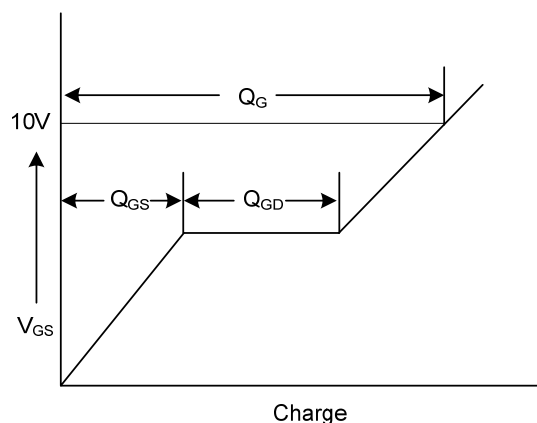
Switching Test Circuit



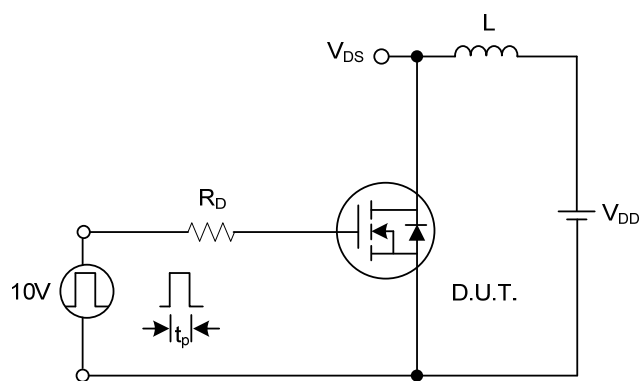
Switching Waveforms



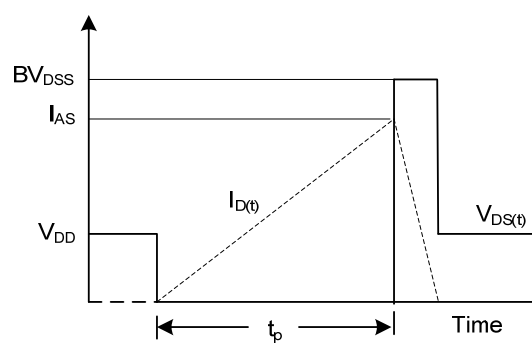
Gate Charge Test Circuit



Gate Charge Waveform

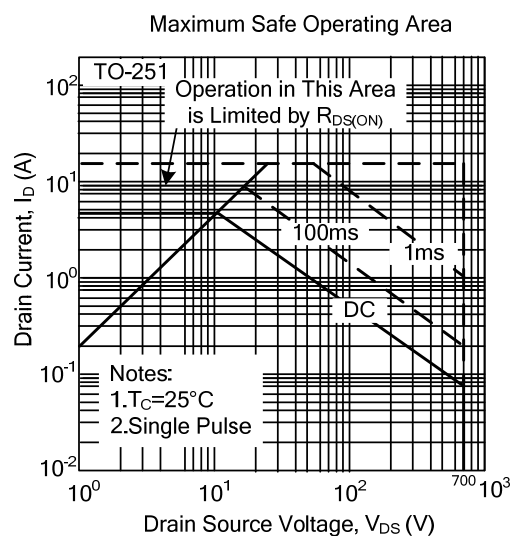
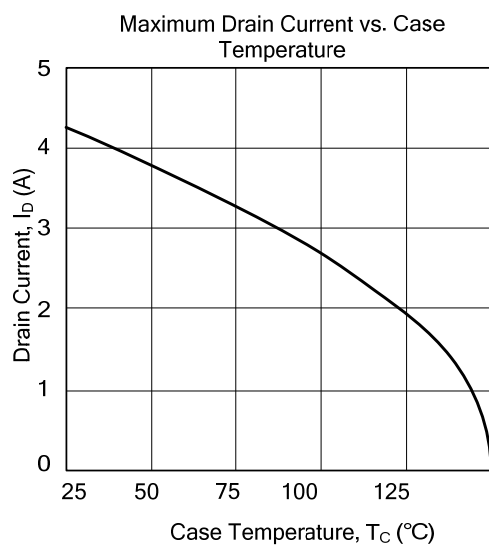
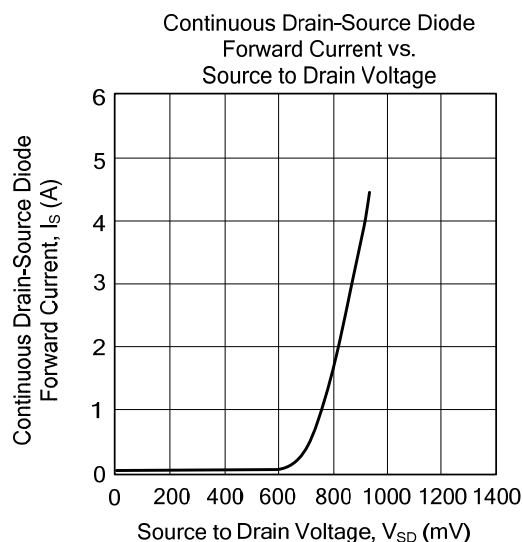
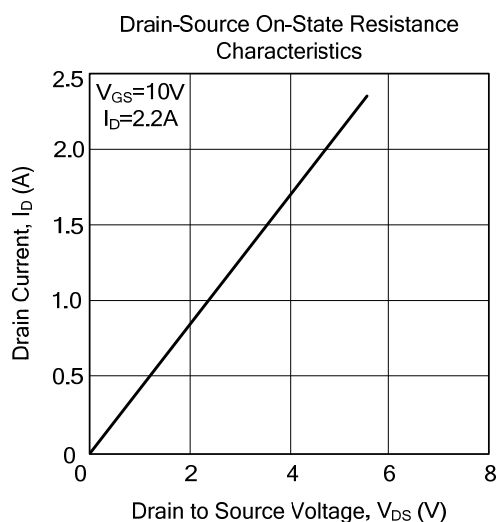
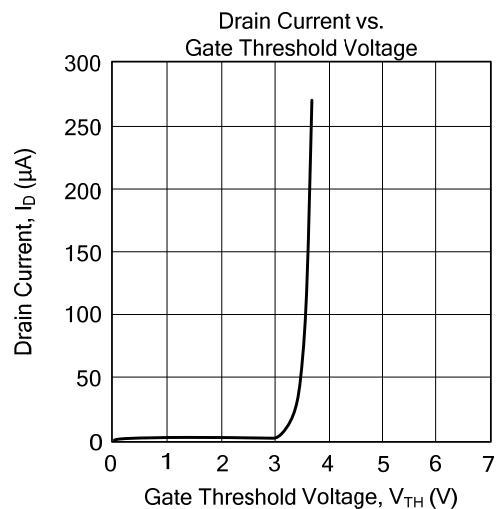
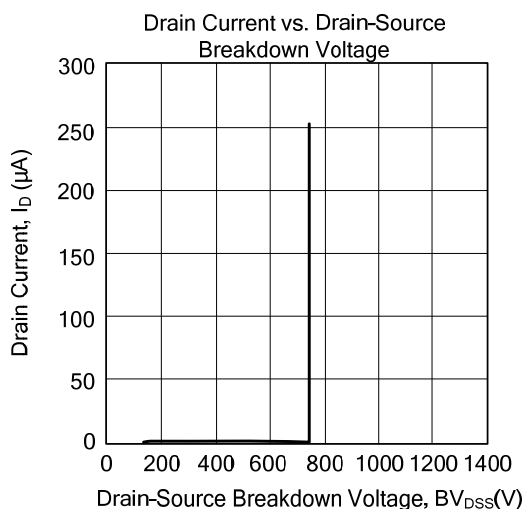


Unclamped Inductive Switching Test Circuit



Unclamped Inductive Switching Waveforms

■ TYPICAL CHARACTERISTICS



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